



From Crop to Clinic: The Anti-Carcinogenic Power of Berries and the Development of the Berry Industry in Ohio

Cancer is the second-leading cause of death in the United States. According to the American Cancer Society's 2005 Cancer Facts and Figures, this disease is responsible for one in every four deaths in the country. In Ohio, an estimated 59,680 people will develop cancer during 2005, and 24,790 will die as a result of this affliction. Cancer is not only deadly, but also expensive—the National Institutes of Health estimate overall costs for cancer in 2004 at \$189.8 billion, including medical costs and the costs associated with loss of productivity due to illness and premature death.

One of the Society's top priorities is cancer research and prevention. Scientific evidence suggests that about one-third of the 570,280 cancer deaths expected to occur in 2005 will be related to nutrition, physical inactivity, and overweight and obesity, and thus could be prevented.

Functional foods—those eaten as preventive measures against disease—have the potential to become an important tool to fight cancer before it develops. That is why an interdisciplinary team of Ohio State University food, agricultural, and medical researchers are studying berries to determine if they can stop or slow some of the biological processes that contribute to the development or spread of certain types of cancer.

This "crop-to-clinic" research project—which has brought together experts from the College of Food, Agricultural, and Environmental Sciences (including the Ohio Agricultural Research and Development Center and OSU Extension), the College of Medicine and Public Health, the College of Pharmacy, and the College of Dentistry—is looking at the nutraceutical, or disease prevention, value of different berries in fighting oral, esophageal, and colon cancers.

Berries being researched include black and red raspberries, blackberries, strawberries, and elderberries. The team is also interested in two new fruits—autumnberry, which grows wild on the East Coast and has a high lycopene content, and cornelian cherry, which is eaten in Europe.

OBJECTIVES

The research program aims to determine the ability of freeze-dried berries and berry extracts to prevent the development of cancer in multiple sites; determine the mechanism(s) by which berries inhibit cancer; and identify the active inhibitory compounds in berries that are responsible for disease prevention and treatment.



CHALLENGES

One of the challenges project researchers are addressing is finding out which compound, or combination of compounds, is responsible for protecting cells against becoming cancerous or stopping their growth once they are cancerous. The team is using state-of-the-art analytical techniques—such as coupled liquid chromatography tandem mass spectrometry—to measure the components present in berries that are absorbed into cells and tissues.

Scientists are also studying the differences among berry varieties and cultivars, the effects of environmental factors and processing methods on chemical composition, and the differences in nutrient availability during the different stages of ripening. The goal of this work is to determine which management practices and varieties produce berries with the maximum cancer-fighting benefits.

ACHIEVEMENTS

In laboratory studies, project scientists have found that freeze-dried berries can inhibit the development of oral, esophageal, and colon cancers in rodents. The berries prevented carcinogens from being converted into forms that cause DNA damage and also slowed down the growth of pre-malignant cells.

Such promising results have led to the establishment of human clinical trials. In one of the studies, patients with early-stage colon cancer who are candidates for surgery are being fed freeze-dried black raspberries. During surgery, tissue will be examined to see if the berries made any difference in cell growth and death rates, degree of inflammation, activity of certain genes, and the extent of new blood vessel growth at the tumor sites. Colorectal cancer is the third most common cancer among men and women in the United States, and 6,500 Ohioans are expected to develop the disease in 2005.

Other studies underway are examining the effect of black raspberries in liquid form to treat patients with esophageal cancer. Researchers in another trial are evaluating the berries in a chewy, lozenge form in patients with oral cancers. The team has also developed a raspberry bio-adhesive gel, which researchers are planning to use to treat people with pre-cancerous lesions in their mouths.

THE FUTURE

The berry research project has received nearly \$2.4 million in federal funding from the U.S. Department of Agriculture (USDA). These new federal funds will be used to evaluate the potential protective effect of berries on cancers of the cervix and the skin—two major types of cancer afflicting Ohioans.

The promising results of this project are generating a higher demand for berries from consumers and increased interest among Ohio farmers. The Ohio State University South Centers at Piketon are actively promoting berries as an alternative high-value crop for southern Ohio growers and educating consumers on the health benefits. The potential for economic development paired with increased citizen well-being is significant.

for more information

If you would like more information on SEEDS: The OARDC Research Enhancement Competitive Grants Program, please visit our web site at: www.oardc.ohio-state.edu/recgp or contact 614-292-2950.



COLLEGE OF DENTISTRY
COLLEGE OF PHARMACY

This research is supported in part by state of Ohio funds allocated to the Ohio Agricultural Research and Development Center of The Ohio State University.